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THE ORIGIN OF THE MIDDLE OCELLUS OF THE ADULT INSECT.

(PRELIMINARY COMMUNICATION.)

CHUJIRO KOCHI.

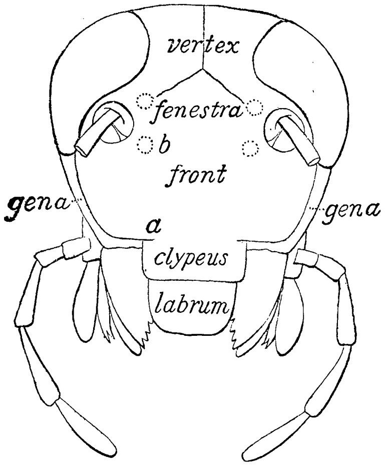
MANY years have passed since Leydig and Brandt called attention to the fact that one of the three ocelli in the adult insect situated in its median line was double. I do not know whether there exists to-day any accurate theory of the origin of this middle ocellus. Most entomologists have simply regarded it as the fusion of two ocelli which once occurred separately in the ancestral form. If this theory is true, there must be some relics left in the generalized type of the insect by which we may trace out the original number of the ocelli, *i.e.*, two pairs in all.

Among all the orders of the insects the Orthoptera is perhaps the most generalized one. Among the Orthoptera I shall refer to the cockroach as being one of the oldest, least modified, and, in many ways, very instructive for comparing it with the other specialized forms of insects.

The head of the cockroach (*Blatta orientalis*) is vertically elongated, having a semicircular outline above, and narrowing downwards. The dorsal part of the head is the vertex, and a median suture may be seen traversing it from before backward, and dividing between the eyes into two branches, one of which passes toward the articulation of each antenna to form a *V*-shaped suture. The cephalic portion of this suture is the front, which was called the "clypeus" by Huxley, as well as by Miall and Denny in their work on the anatomy of this insect. Perhaps they did not notice that the clypeus was a small sclerite, situated above the labrum, and separated from the front by a curved suture at the point *a*. This suture also divides the gena from the front on each side of the head.

The basal joint of the antenna is articulated with the front by a transparent flexible membrane, the antennary fossa, and allows of the free play of the antenna. On the inner side of and above the antennary fossa there is a peculiar membranous area of paler color — the fenestra. According to Sedgwick this fenestra is replaced by an ocellus in some cockroaches (the males of Corydia and Heterogamia). If so, we must regard this fenestra as a rudimentary ocellus.

A little below the fenestra, and in the broad, flattened region of the front, there is another peculiar spot marked *b*, which seems to have escaped the notice of all observers. This spot is, however, more prominent than the fenestra, and it looks like one of the originally paired ocelli, which afterward migrated toward the median line and fused together to form a middle ocellus in other insects.



There often occur some perplexing dark spots in the head of the insects, surrounding their ocelli, but they vary a great deal in size and number as well as in shape and position. But in the cockroach these four spots are always present throughout all the species I have examined. Two of them are regularly situated in the vertex, near its cephalic margin (sometimes they are situated on the boundary line between the vertex and the front), while the other two are seen in the front, a little below the antenna.

This peculiar appearance of the four spots led me to investigate the occurrence of the original four ocelli. In deciding this question I have made several microtome sections and stained them by the various methods. The preparations have not only shown the connection of the nervous system with these four spots, but their histological characters threw a light upon the nature of their origin as the optical organs.

The complete account of my studies on this subject, with some illustrations, may be published in the near future; therefore I shall leave only the preliminary statement here for the present.

Cornell University, Ithaca, N. Y.,
June 10, 1900.